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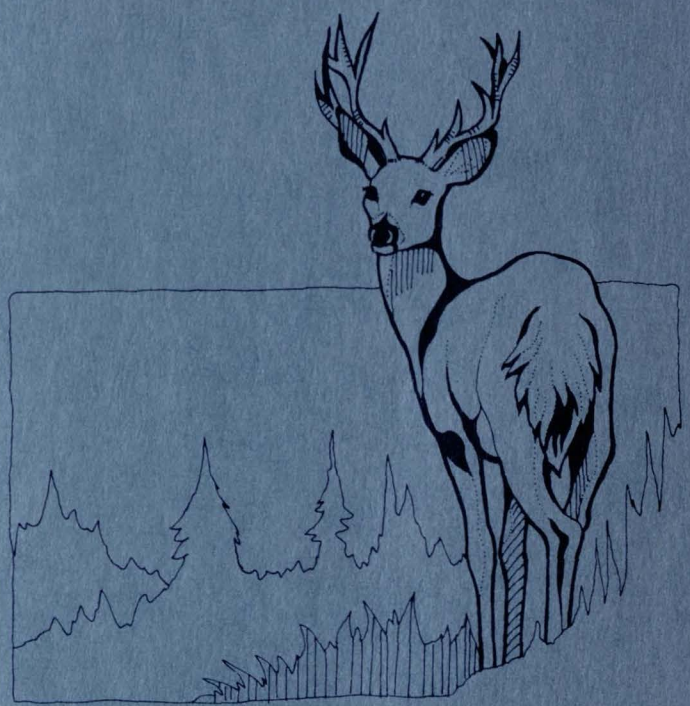

FOODS
of white-tailed deer in the Upper Great Lakes Region — a review

Lynn L. Rogers, Jack J. Mooty, and Deanna Dawson

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

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North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota

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FOODS OF WHITE-TAILED DEER IN THE UPPER GREAT LAKES REGION—A REVIEW

Lynn L. Rogers, *Wildlife Biologist,*
North Central Forest Experiment Station,
St. Paul, Minnesota

Jack J. Mooty, *Wildlife Biologist,*
Minnesota Department of Natural Resources
Grand Rapids, Minnesota

and **Deanna Dawson,** *Wildlife Biologist,*
North Central Forest Experiment Station,
St. Paul, Minnesota

This report summarizes available information on the food habits of white-tailed deer *(Odocoileus virginianus)* in the northern forests of Minnesota, Wisconsin, and Michigan (fig. 1). This area, referred to here as the Upper Great Lakes Region (UGLR), is near the northern edge of the white-tail's present range (Taylor 1956).

Deer were not abundant in the mature, pine-dominated, "virgin" forests of the UGLR. However, the young hardwood forests created by large-scale logging and extensive forest fires allowed deer to expand their range northward (Swift 1946, Stenlund 1958, Erickson *et al.* 1961). Today, deer are important both aesthetically and economically in the UGLR. They are viewed and photographed as an important adjunct to the Region's tourist industry, and hunters spend over 200 million dollars a year on deer hunting (USDI 1977). Deer are also the main prey of the timber wolf *(Canis lupus)* in the UGLR. This Region has the only sizable population of wolves in the contiguous United States (Mech and Karns 1977).

The young forest that brought deer to the UGLR is now reaching maturity, and deer populations are declining (Byelich 1965, Stone 1966, Mooty 1971, Mech and Karns 1977). State governments in this Region are now spending nearly 2 million dollars a year on deer habitat improvement. However, optimal habitat management is difficult because the year-round food habits of deer in the UGLR have not been documented thoroughly. Study of growing-season food habits was begun only recently (Kohn and Mooty 1971, McCaffery *et al.* 1974, Mooty 1976, Bauer 1977). This review emphasizes the need for further information and is a step toward disseminating available information on deer food habits.

Research methods to obtain information on food habits of deer in the UGLR have included analyzing stomach contents, examining feeding sites, and observing tame deer on a leash. None of these methods gives a complete picture of food habits, and each has a different bias as will be discussed below. However, each method gives an approximation of the diet. Results of studies conducted in seven areas of the UGLR during 1936-1976 are presented in tables 1-12 (Appendix). Differences in reported diets reflect local differences in vegetation and differences in methods of study. Omitted from the tables are results of seven studies (Hammerstrom and Blake 1939, Swift 1946, Dahlberg and Guettinger 1956, Krefting and Hansen 1963, Orke 1966, McCaffery and Kohn 1971, and Hennings 1977) that did not permit percentage

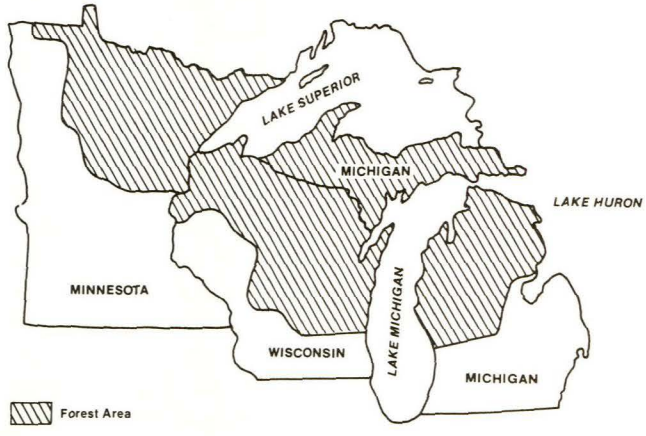

Figure 1.—*Northern forest area of the midwestern United States.*

breakdowns of diet or presentation by month. However, common and scientific names of foods mentioned in those studies are included in Appendix II which lists reported deer foods in the UGLR.

SEASONAL FOODS OF DEER IN THE UPPER GREAT LAKES REGION

Foods of deer can be categorized into such groups as woody browse, conifer needles, evergreen forbs, nonevergreen forbs, deciduous leaves, fruit, fungi, etc. Use of these groups by deer follows a seasonal trend throughout the UGLR despite local differences in vegetation.

In winter, woody browse usually is the main food available, and it forms the bulk of the diet (tables 1-4, 11-12). This food is low in nutrient quality and digestibility, and deer lose weight on it even when it is available in unlimited quantities (Ullrey *et al.* 1964, 1967, 1968, Verme and Ullrey 1972, Grigal *et al.* 1979). A prolonged diet of woody browse causes malnutrition and starvation (Mautz 1978), both of which are common in the UGLR in late winter (Bartlett 1938, Erickson *et al.* 1961, Stenlund 1970 Karns 1980).

Although cedar is a preferred winter food (Dahlberg and Guettinger 1956), needles of balsam fir, spruce, and pine apparently make an even poorer diet than most woody browse species. These needles comprised 58 to 60 percent of the rumen contents of starved deer autopsied in late winter during population highs of past decades (Aldous and Smith 1938, Dahlberg and Guettinger 1956). However, these needles made up only a small portion of the winter diet of healthier deer studied more recently (tables 1-3). Among the latter deer, the greatest use of balsam fir, pine, and spruce needles was by deer that eventually were killed by wolves. Sixteen percent of the stomach contents of 32 wolf-killed deer were needles of these species (Wetzel 1972).

After the rigors of a northern winter and a nutritionally marginal diet, fat reserves are depleted and deer become nutritionally stressed (Verme 1969, Mautz 1978, Karns 1980). In early spring, metabolic rates increase, does are in the last months of pregnancy, and a high quality diet is essential to both survival and reproductive success (Julander and Robinette 1950, Longhurst *et al.* 1952, Verme 1963, 1969, Silver *et al.* 1969). As snow melts on south-facing slopes and around the bases of trees in the uplands, deer begin supplementing their browse diets with leaves of small plants that remain green overwinter: bunchberry, wintergreen, strawberry, and barren strawberry (McCaffery and Kohn 1971). As spring progresses, new green grass, emerging forbs, and new leaves of trees and shrubs become available. Woody twigs and evergreen forbs are forsaken, and new green growth forms over 90 percent of the diet (table 4 and 5) (Pierce 1975). This vegetation is both nutritious and easily digestible (Verme and Ullrey 1972). At this time, deer frequently feed in treeless areas such as old fields, roadsides, and powerline rights-of-way which "green up" earlier than the surrounding forests (McCaffery and Creed 1969).

In late spring and early summer, deer, like moose *(Alces alces)*, are sometimes observed eating aquatic vegetation. Hennings (1977) observed deer in northeastern Minnesota selectively eating (in decreasing order of use) burreeds, filamentous algae, ribbonleaf pondweed, water horsetail, arrowhead, sedges, marsh cinquefoil, white pond lily, yellow pond lily, purple watershield, and St. John's-wort. Water milfoil and wild rice also have been reported as deer foods in the UGLR (Dahlberg and Guettinger 1956, Irwin 1974). Aquatic vegetation is fairly nutritious (Linn *et al.* 1973) and may be important in supplying annual requirements of sodium and other nutrients (Botkin *et al.* 1973, Jordan *et al.* 1974, Hanson and Jones 1977). Aquatic feeding reaches its peak during periods of reduced water levels in early summer (Townsend and Smith 1933, Behrend 1966, Skinner and Telfer 1974, Hennings 1977). The portion of the diet that aquatic vegetation comprises during periods of peak use is unknown but is probably low (Hennings 1977, Joyal and Scherrer 1978).

In summer, deer eat the leaves of nonevergreen terrestrial plants, mushrooms, and fruit (Kohn and Mooty 1971, McCaffery *et al.* 1974). Aspen forests, especially poorly stocked stands or those under 25 years of age, are important summer habitats (McCaffery and Creed 1969, Mooty 1971, McCaffery 1976, Bauer 1977, Gullion 1977). Leaves from aspen suckers less than one year old are a preferred food (McCaffery 1976). In northern Wisconsin, where first-year aspen suckers are abundant due to frequent clear-cutting of aspen forests, aspen leaves form a larger portion of the summer diet than does any other item (McCaffery *et al.* 1974). Leaves from older aspen are less preferred, however[1]. Consequently, in northern Minnesota where aspen clear-cutting is less frequent aspen leaves form a smaller part of the summer diet (Kohn 1970, Pierce 1975). Leaves other than those of aspen also are important

[1]*Personal communication with L. Verme, 1980.*

foods in aspen stands. Vegetation studies in Minnesota (Ohmann and Ream 1971), Wisconsin (McCaffery 1976), and Michigan (Bauer 1977) showed that principal summer deer foods such as maple, birch, willow, juneberry, hazel, cherry, honeysuckle, bush-honeysuckle, rose, large-leaf aster, and strawberry are prevalent in aspen stands.

In the fall, nonevergreen leaves become increasingly scarce with the exception of large-leaf aster which persists in frost-sheltered stands into late fall. When nonevergreen leaves and other summer foods become scarce, deer turn to grasses, sedges, and evergreen forbs until these become covered by snow (tables 10 and 11). Then deer once again begin eating dormant woody browse which dominates the diet until the snow melts and the above cycle is repeated.

The seasonal feeding pattern indicates that deer generally prefer young nonevergreen leaves but will eat (in decreasing order of preference) mature nonevergreen leaves, evergreen forbs, cedar leaves, deciduous woody browse, and conifer needles. Preferred foods also may include arboreal fruticose lichens, acorns, fruit, and certain fungi according to studies conducted in other regions (Cushwa *et al.* 1970, Harlow and Hooper 1972, Skinner and Telfer 1974, Crawford *et al.* 1975). Additional study is needed to assess the importance of these foods in the UGLR.

Diversity apparently is important in the deer diet (Verme and Ullrey 1972). Dahlberg and Guettinger (1956) found that captive wintering deer maintained weight better on a variety of second-choice woody browse species than they did on a diet of straight cedar, a first-choice winter food. Miguelle and Jordan (1980) found that captive moose chose a diverse summer diet even when moutain-ash, a highly preferred food, was made available *ad libitum*. Jordan (1967) found deer preference for a species to be highest where that species was scarcest.

Perhaps one of the reasons ruminants choose a diverse diet is to avoid ingesting too much of any one of the many plant compounds that inhibit digestion (Nagy *et al.* 1964, Longhurst *et al.* 1968, Levin 1976). Deer have long been known to select the most nutritious forage available (Swift 1948, Weir and Torell 1959), and it now is apparent deer also detect and avoid compounds that inhibit the action of rumen micro-organisms (Nagy *et al.* 1964, Longhurst *et al.* 1968, Nagy and Regelin 1977). These secondary compounds, as they are called, have little or no impact on rumen micro-organisms at low concentrations (Nagy and Regelin 1977), but at higher concentrations, their inhibitory action accelerates (Nagy and Tengerdy 1968). A wide variety of secondary compounds are found in plants, with the amount and kind varying with species, subspecies, phenology, and site factors (Nagy and Regelin 1977). The palatability of plants decreases as concentrations of certain secondary compounds increase (Nagy and Regelin 1977).

A diverse diet may also benefit deer in another way. Eating certain plants may aid in the digestion of others. For example, some plants are too low in nitrogen, phosphorus, magnesium, or sulfur for adequate rumen digestion, but these plants may be utilized if they are combined with others that provide the deficient elements (Church 1977:138, Hanson and Jones 1977:254, 256).

PROBLEMS OF DEER IN NORTHERN FORESTED VERSUS SOUTHERN AGRICULTURAL DEER RANGES IN THE GREAT LAKES REGION

Deer at the northern edge of their range are limited in number mainly by problems of overwinter mortality and nutrition-related reproductive failures. These problems are eased by improvements in the quantity and quality of year-round food supply such as occur after extensive logging and burning (Erickson *et al.* 1961). However, problems increase in years when access to food patches is restricted by unusually deep or long-lasting snow (Moen 1976, 1978, Nelson and Mech 1980). Deer on the George Reserve in southern Michigan seldom dig through more than 3 inches (7.5 cm) of snow to reach food (Coblentz 1970) and deer in northcentral Minnesota have not been observed to dig through more than 12 inches (30 cm) of snow (Mooty and Rogers, personal observations). Travel becomes difficult when deer sink beyond their chests (about 20 inches (50 cm)) (Formozov 1946, Edwards 1956, Gilbert *et al.* 1970). Snow in the northern forests of Minnesota, Wisconsin, and Michigan becomes more than 20 inches deep nearly every winter (Environmental Science Services Administration 1968), burying low-growing plants beyond reach and hampering travel to the extent that even woody browse becomes difficult to obtain in quantity. By comparison, snow in the southern portions of these States usually is not as deep or long-lasting.

Studies in agricultural areas in Minnesota showed that snow-free patches enable deer to eat nonwoody foods longer than is usual in the UGLR (Moen 1966). The higher nutritional plane in these agricultural areas helps deer to withstand cold weather (Moen 1966). They spend much of their active and resting time near their food supplies in open fields and are not as likely to use heavy cover in winter as are deer farther north (Verme 1965, Moen 1966, Wetzel 1972). Deer in agricultural areas also show faster growth rates and higher reproductive rates than those in the forested north. Yearling bucks in southern Minnesota average 130 pounds (59 kg) field-dressed, while those in northeastern Minnesota average only 106 pounds (48 kg).[2] Between 29 and 52 percent of female fawns in southern Minnesota, Wisconsin, and Michigan become pregnant compared with only 3 to 11 percent in the northern portions of those states (Verme and Ullrey 1972, Harder 1980).

Deer in agricultural areas are able to achieve very high densities where hunting and other human-related mortality factors are controlled. A confined herd at the Twin Cities Army Ammunition Plant (TCAAP) achieved a density of 200 deer per square mile (77/km^2)[3], which is several times higher than densities recorded anywhere in the UGLR (Olson 1938, Erickson *et al.* 1961). Deer at the TCAAP usually survived overwinter by digging through shallow snow for herbaceous material[3]. In years when access to herbaceous material was prevented by an ice crust, fawns starved[3]. Herbaceous material is seldom available during winter in northern Minnesota forests.

Deer habitat in northern Lake and Cook Counties, in the northeastern corner of Minnesota, is deteriorating due to succession of aspen forest to balsam fir and spruce (Erickson *et al.* 1961, Urich 1973, Mech and Karns 1977). Nevertheless, the area still appears capable, from a food standpoint, of supporting at least 10 deer per square mile (4/km^2)[3]. However, during the late 1960s and early 1970s, a series of winters with unusually deep or long-lasting snow caused starvation and reproductive failure among those deer and made escape from timber wolves more difficult (Mech and Karns 1977). These natural factors, together with hunting by man, caused a severe decline in the deer population during the early 1970s (Mech and Karns 1977). Deer numbers fell to fewer than two per square mile (l/km^2) (Floyd *et al.* 1979) in some areas that formerly had been among the best deer hunting areas in the state (Olson 1938). Deer numbers declined to some extent throughout the UGLR (Mech and Karns 1977), but more recently, deer numbers over much of the UGLR have recovered considerably due to a return to more normal winters and tighter restrictions on deer hunting (Mech and Karns 1977, [4]). However, in northeastern Minnesota, where losses to timber wolves are high (Mech and Karns 1977), no increase in deer numbers was detected through 1978 (Floyd *et al.* 1979).

RESEARCH NEEDS IN THE UPPER GREAT LAKES REGION

Additional information is needed on deer diets in the snowfree seasons. Most previous studies in the UGLR were conducted in winter because it is then that food is scarcest and starvation greatest. However, it is now known that deer in the UGLR are "semi-hibernators"; in winter, their metabolic rates decrease, they are less active, and they require less food (Silver *et al.* 1969, Thompson *et al.* 1973, Moen 1978). Studies of captive deer in northern Michigan showed some deer can survive overwinter even if they have no food for several weeks (Ozoga and Verme 1970). It is now apparent that overwinter survival depends not only on winter conditions but on the energy reserves deer accumulate before winter begins (Mautz 1978).

Knowledge of spring diet might prove useful to managers because the spring diet of pregnant does is especially crucial to the survival of their fawns (Verme 1962). Studies of captive deer showed that fawn mortality was less than 33 percent when mothers that were undernourished in winter were well-nourished in spring. However, when mothers were undernourished in both winter and spring, fawn mortality rose to 90 percent (Verme 1962). Growth of fawns depends largely on summer and fall nutrition, and the fall weight of female fawns largely determines whether or not the fawns will breed (Harder 1980).

Information on diet during the snowfree months is difficult to obtain because present techniques are not well suited for determining diet during that period. One of the most common techniques, examining feeding sites, depends upon deer leaving part of each food plant behind so observers can see that some has

[2]*Unpublished data by Ludwig and Karns on file.*
[3]*Personal communication with Karns, 1978.*
[4]*Personal comunication with Wm. Creed, 1980.*

been eaten. This is a suitable method for approximating use of woody browse and large herbaceous plants. However, any feeding on small plants that are nipped off close to the ground, and any feeding on items that deer eat whole (mushrooms, berries, acorns, nuts, dried leaves, and lichens) is difficult to detect by this method. Moreover, unless radio-collared deer are used, feeding sites are difficult to find in the forest, so those examined tend to be in open or muddy areas where deer or their tracks are more visible (Peek 1975). According to Wallmo *et al.* (1973), inability to distribute the feeding site sample in proper relation to the distribution of deer feeding leads to underestimation of use of shrubs and forbs and overestimation of use of grasses. Aquatic feeding is missed entirely. Other problems with this method are determining how much of each species was eaten and whether browsing occurred days or months before the examinations (Peek 1975).

Rumen analyses also are fraught with problems. Usually only a small portion of the rumen material is identifiable, with the identifiable items often being the least digestible ones (Bergerud and Russell 1964). Moreover, rumen contents usually are collected from deer killed along roads or in large open areas. Consequently, results are biased toward roadside grasses and other foods that grow in the open. In areas of low deer density, obtaining adequate samples of rumens in all seasons is another major difficulty.

Recently, observations of tame, harnessed deer have been used to determine summer food habits. Where comparisons have been made, food selections by tame deer did not differ from those of wild deer in similar habitats (Healy 1967, Longhurst *et al.* 1968, Wallmo and Neff 1970). However, in all studies using tame white-tailed deer, the researcher selected the feeding habitat. None of the available methods can be used to determine seasonal changes in amounts consumed per day.

Clearly, there is a need to develop improved techniques for determining food habits—especially for the snowfree months. An observation by Watts (1964) that an escaped tame deer remained tame after 2 weeks of freedom suggests that harnesses are unnecessary and that attempts should be made to study tame radio-marked deer living unfettered and full time on natural ranges. Such deer could become fully familiar with the habitats and foods available in their home ranges and could select them without being hindered by researchers. Feeding data obtained by observing these deer would not be biased in the ways inherent in the other methods mentioned. Around-the-clock observations of these deer in all seasons would reveal any day-night differences in habitat use and any seasonal differences in daily consumption rates. The validity of this approach might be tested, in part, by determining whether the tame deer survive, reproduce, and raise young as successfully as wild ones under conditions of severe winters and predation by timber wolves. The number of deer required for such study would depend upon the extent to which individuals differed from one another in their food preferences.

Land managers need more information on year-round diet in order to determine which timber management practices produce the best deer habitats. Information on year-round diet also is needed to determine the effects of such natural factors as fire, drought, plant disease, and defoliating insects on deer habitat. These factors can change both the kinds and the nutritional values of the plants available to deer (McEwen and Dietz 1965, Halls and Epps 1969, Urich 1973, Lyon *et al.* 1978, Ohmann and Grigal 1979). Information on year-round diet will lead to a better understanding of the relations between deer and their habitat and will enable land managers to maximize the benefits from deer habitat management funds.

LITERATURE CITED

Aldous, S. E., and C. F. Smith. 1938. Food habits of Minnesota deer as determined by stomach analysis. Transactions of the North American Wildlife Conference 3:756-767.

Bartlett, I. H. 1938. White-tail—presenting Michigan's deer problem. Michigan Department of Conservation Game Division Bulletin, 64 p.

Bauer, W. A. 1977. Forage preferences of tame deer in the aspen type of northern Michigan. 85 p. M.S. Thesis, Michigan Technological University. Houghton, Michigan.

Behrend, D. F. 1966. Correlation of white-tailed deer activity, distribution and behavior with climatic and other factors. New York State Conservation Department, Job Completion Report, Project W-105-R-7, 78 p.

Bergerud, A. T., and L. Russell. 1964. Evaluation of rumen food analyses for Newfoundland Caribou. Journal of Wildlife Managment 28(4):809-814.

Botkin, D. B., P. A. Jordan, A. S. Dominski, H. S. Lowendorf, and G. E. Hutchinson. 1973. Sodium dynamics in a northern ecosystem. Proceedings of the National Academy of Science 70(10):2745-2748.

Byelich, J. D. 1965. Deer and forest management: Lake States. Proceedings of American Foresters 233-234.

Church, D. C. 1977. Livestock feeds and feeding. 349 p. D. C. Church, publisher. O and B Books, Distributor. Corvallis, Oregon.

Coblentz, B. E. 1970. Food habits of George Reserve deer. Journal of Wildlife Management 34(3):535-540.

Crawford, H. S., J. B. Whelan, R. F. Harlow, and J. E. Skeen. 1975. Deer range potential in selective and clearcut oak-pine stands in southwestern Virginia. U.S. Department of Agriculture Forest Service, Research Paper SE-134, 12 p. U.S. Department of Agriculture Forest Service, Southeastern Forest Experiment Station Asheville, North Carolina.

Cushwa, C. T., R. L. Downing, R. F. Harlow, and D. F. Urbston. 1970. The importance of woody twig ends to deer in the Southeast. U.S. Department of Agriculture Forest Service, Research Paper SE-67, 12 p. U.S. Department of Agriculture Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina.

Dahlberg, B. L., and R. C. Guettinger. 1956. The white-tailed deer in Wisconsin. Wisconsin Conservation Department Technical Wildlife Bulletin 14. 282 p. Madison, Wisconsin.

Edwards, R. Y. 1956. Snow depths and ungulate abundance in the mountains of western Canada. Journal of Wildlife Management 20(2):159-168.

Environmental Science Services Administration. 1968. Climatic atlas of the United States. 80 p. U.S. Department of Commerce.

Erickson, A. B., V. E. Gunvalson, M. H. Stenlund, D. W. Burcalow, and L. H. Blankenship. 1961. The white-tailed deer in Minnesota. Minnesota Department of Conservation Technical Bulletin 5, 64 p.

Floyd, T. J., L. D. Mech, and M. E. Nelson. 1979. An improved method of censusing deer in deciduous-coniferous forests. Journal of Wildlife Management 43(1):258-261.

Formozov, A. N. 1946. Snow cover as an integral factor of the environment and its importance in the ecology of mammals and birds. Materials for Fauna and Flora of the USSR. New series Zoology 5, 152 p. (Translation from Russian) Boreal Institute, University of Alberta.

Gilbert, P. F., O. C. Wallmo, and R. B. Gill. 1970. Effect of snow depth on mule deer in Middle Park, Colorado. Journal of Wildlife Management 34(1):15-23.

Grigal, D. F., L. F. Ohmann, and N. R. Moody. 1979. Nutrient content of some tall shrubs from Northeastern Minnesota. U.S. Department of Agriculture Forest Service, Research Paper NC-168, 10 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Gullion, G. W. 1977. Maintenance of the aspen ecosystem as a primary wildlife habitat. p. 256-265 *In* XIIIth International Congress of Game Biology. T. J. Peterle, ed. Proceedings of The Wildlife Society, Wildlife Management Institute, Washington, D.C.

Halls, L. K., and E. A. Epps, Jr. 1969. Browse quality influenced by tree overstory in the south. Journal of Wildlife Management 33(4):1028-1031.

Hammerstrom, F. N., Jr., and J. Blake. 1939. Winter movements and winter foods of white-tailed deer in central Wisconsin. Journal of Mammalogy 20:315-325.

Hanson, H. C., and R. L. Jones. 1977. The biogeochemistry of blue, snow, and Ross' geese. 320 p. Illinois Natural History Survey. Urbana, Illinois.

Harder, J. D. 1980. Reproduction of white-tailed deer in the north central United States. P. 23-35. *In* Ruth L. Hine and Susan Nehls, eds. White-tailed deer population management in the north-central States. Proceedings 1979 Symposium North Central Section Wildlife Society. 116 p.

Harlow, R. F., and R. G. Hooper. 1971. Forages eaten by deer in the southeast. Southeast Association of Game and Fish Commissioners Annual Conference Proceedings 25:18-46.

Healy, W. M. 1967. Forage preferences of captive deer while free- ranging in the Allegheny National Forest. 93 p. M.S. Thesis. Pennsylvania State University, University Park, Pennsylvania.

Irwin, L. L. 1974. Relationship between deer and moose on a burn in northeastern Minnesota. 51 p. M.S. Thesis, University of Idaho, Moscow, Idaho.

Jordan, P. A. 1967. Ecology of migratory deer in the San Joaquin river drainage. 278 p. Ph.D. Dissertation. University of California, Berkeley, California.

Jordan, P. A., D. B. Botkin, A. S. Dominski, H. S. Lowendorf, and G. E. Belovsky. 1974. Sodium as a critical nutrient for the moose of Isle Royale. Proceedings of the North American Moose Conference Workshop 9:13-42.

Joyal, R., and B. Scherrer. 1978. Summer movements and feeding by moose in western Quebec. Canadian Field-Naturalist 92(3):252-258.

Julander, O., and W. L. Robinette. 1950. Deer and cattle range relationships on Oak Creek range in Utah. Journal of Forestry 48(6):410-415.

Karns, P. D. 1980. Winter—the grim reaper. Proceedings of the Symposium on white-tailed deer management in the North Central U.S. [In press].

Kohn, B. E. 1970. Summer movements, range use, and food habits of white-tailed deer in north central Minnesota. 38 p. M.S. Thesis, University of Minnesota, St. Paul, Minnesota.

Kohn, B. E., and J. J. Mooty. 1971. Summer habitat of white-tailed deer in north central Minnesota. Journal of Wildlife Management 35(3):476-487.

Krefting, L. K., and H. L. Hanson. 1963. Use of phytocides to improve deer habitat in Minnesota. Southern Weed Control Conference (Mobile, Alabama) 16:209-216

Levin, D. A. 1976. The chemical defenses of plants to pathogens and herbivores. Annual review of ecology and systematics 7:121-159.

Linn, J. G., R. D. Goodrich, J. C. Meiske, and J. Staba. 1973. Aquatic plants from Minnesota: Part 4—nutrient composition. Water Resources Research Center Bulletin 56, 22p. University of Minnesota, St. Paul, Minnesota.

Longhurst, W. M., A. S. Leopold, and R. F. Dasmann. 1952. A survey of California deer herds, their ranges and management problems. California Department of Fish and Game. Game Bulletin 6, 136 p.

Longhurst, W. M., H. K. Oh, M. B. Jones, and R. E. Kepner. 1968. A basis for the palatability of deer forage plants. North American Wildlife Proceedings 33:181-192.

Lyon, L. J., H. S. Crawford, E. Czuhai, R. L. Fredrikson, R. F. Harlow, L. J. Metz, and H. A. Pearson. 1978. Effects of fire on fauna. U.S.Department of Agriculture Forest Service, General Technical Report WO-6. 41 p.

Mautz, W. W. 1978. Sledding on a bushy hillside: the fat cycle in deer. Wildlife Society Bulletin 6(2):88-90.

Maycock, P. F., and J. T. Curtis. 1960. The phytosociology of boreal conifer-hardwoods forests of the Great Lakes Region. Ecological Monograph 30:1-35.

McCaffery, K. R. 1976. Vegetation characteristics of aspen stands. Wisconsin Department of Natural Resources Final Report, Project W-141-R-11, Study 205, 27 p. mimeo.

McCaffery, K. R., and W. A. Creed. 1969. Significance of forest openings to deer in northern Wisconsin. Wisconsin Department Natural Resources Technical Bulletin 44, 104 p.

McCaffery, K. R., and B. E. Kohn. 1971. Relation of forest cover types to deer populations. Wisconsin Department of Natural Resources Progress Report, Project W-141-R-6, Study 201, 9 p. mimeo.

McCaffery, K. R., J. Tranetzke, and J. Piechura, Jr. 1974. Summer foods of deer in northern Wisconsin. Journal of Wildlife Management 38(2):215-219.

McEwen, L. C., and D. R. Dietz. 1965. Shade effects on chemical composition of herbage in the Black Hills. Journal of Range Management 18(4):184-190.

Mech ,L. D., and P. D. Karns. 1977. Role of the wolf in a deer decline in the Superior National Forest. U.S. Department of Agriculture Forest Service, Research Paper NC-148, 23 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Miguelle, D. G., and P. A. Jordan. 1980. The importance of diversity in the diet of moose. In Proceedings 15th North American Moose Conference Workshop. [In press].

Moen, A. N. 1966. Factors affecting the energy exchange and movements of white-tailed deer in western Minnesota. 121p. Ph.D. Thesis, University of Minnesota, St. Paul, Minnesota.

Moen, A. N. 1968. Surface temperatures and radiant heat loss from white-tailed deer. Journal of Wildlife Management 32(2):338-344.

Moen, A. N. 1976. Energy conservation by white-tailed deer in the winter. Ecology 57:192-198.

Moen, A. N. 1978. Seasonal changes in heart rates, activity, metabolism, and forage intake of white-tailed deer. Journal of Wildlife Management 42:715-738.

Mooty, J. J. 1971. The changing habitat scene. p. 27-33. *In* The white-tailed deer in Minnesota. M. N. Nelson, ed. 88 p. Minnesota Department of Natural Resources.

Mooty, J. J. 1976. Year-round food habits of white-tailed deer in northern Minnesota. Minnesota Wildlife Research Quarterly 36(1):11-36.

Nagy, J. G., and W. L. Regelin. 1977. Influence of plant volatile oils on food selection by animals. XIIIth International Congress of Game Biologists:225-230.

Nagy, J. G., and R. P. Tengerdy. 1968. Antibacterial action of essential oils of *Artemisia* as an ecological factor. II. Antibacterial action of the volatile oils of *Artemisia tridentata* (big sagebrush) on bacteria from the rumen of mule deer. Applied Microbiology 16:441-444.

Nagy, J. G., H. W. Steinhoff, and G. M. Ward. 1964. Effects of essential oils of sagebrush on deer rumen microbial function. Journal of Wildlife Management 28:785-790.

Nelson, M. E., and L. D. Mech. 1980. Effects of winter severity on winter deer weights in Minnesota. Journal of Wildlife Management [In press].

Ohmann, L. F., and D. F. Grigal. 1979. Early revegetation and nutrient dynamics following the 1971 Little Sioux forest fire in northeastern Minnesota. Forest Science Monograph 21, Supplement to Forest Science 25(4), 80 p.

Ohmann, L. F., and R. R. Ream. 1971. Wilderness ecology: virgin plant communities of the Boundary Waters Canoe Area. U.S. Department of Agriculture Forest Service Research Paper NC-63, 55 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Olson, H. F. 1938. Deer tagging and population studies in Minnesota. Transactions North American Wildlife Conference 3:280-286.

Orke, D. N. 1966. Patterns and intensity of white-tailed deer browsing on the woody plants of Itasca State Park. 61 p. M. S. Major Report. University of Minnesota, St. Paul, Minnesota.

Ozoga, J. J., and L. J. Verme. 1970. Winter feeding patterns of penned white-tailed deer. Journal of Wildlife Management 34(2):431-439.

Peek, J. M. 1975. A review of moose food habits studies in North America. Naturaliste Canadien 101:193-215.

Pierce, D. E., Jr. 1975. Spring ecology of white-tailed deer in north central Minnesota. 55 p. M. S. Thesis. University of Minnesota, St. Paul, Minnesota.

Silver, H., N. F. Colovos, J. B. Holter, and H. H. Hayes. 1969. Fasting metabolism of white-tailed deer. Journal of Wildlife Management 33(3):490-498.

Skinner, W. R., and E. S. Telfer. 1974. Spring, summer, and fall foods of deer in New Brunswick. Journal of Wildlife Management 38(2):210-214.

Stenlund, M. 1958. A history of Itasca County deer. Conservation Volunteer 21(125): 19-24.

Stenlund, M. 1970. Deer wintering conditions and mortality report. Minnesota Quarterly 30(2):102-103.

Stone, R. N. 1966. A third look at Minnesota's timber. U.S. Department of Agriculture Forest Service Bulletin NE-1, 64 p. U.S. Department of Agriculture Forest Service, Northeastern Forest Experiment Station, Broomall, Pennsylvania.

Swift, E. 1946. A history of Wisconsin deer. Wisconsin Conservation Department Publication 323, 96 p.

Swift, E. 1948. Deer select most nutritious forages. Journal of Wildlife Management 12:109-110.

Taylor, W. P. 1956. The deer of North America. 668 p. The Stackpole Company and The Wildlife Management Institute, Washington, D. C.

Thompson, C. B., J. B. Holter, H. H. Hayes, H. Silver, and W. E. Urban, Jr. 1973. Nutrition of white-tailed deer. I. Energy requirements of fawns. Journal of Wildlife Management 37(3):301-311.

Townsend, M. T., and M. W. Smith. 1933. The white-tailed deer of the Adirondacks. (1) Preliminary survey of the white-tailed deer of the Adirondacks, (2) Ecology of the white-tailed deer in summer with special reference to Adirondacks. Roosevelt Wildlife Bulletin 6(2):161-325.

Ullrey, D. E., W. G. Youatt, H. E. Johnson, P. K. Ku, and L. D. Fay. 1964. Digestibility of cedar and aspen browse for the white-tailed deer. Journal of Wildlife Management 28(4):791-797.

Ullrey, D. E., W. G. Youatt, L. D. Fay, B. E. Brent, and K. E. Kemp. 1967. Digestibility of cedar and jack pine browse for the white-tailed deer. Journal of Wildlife Management 31(3):448-454.

Ullrey, D. E., W. G. Youatt, L. D. Fay, B. E. Brent, and K. E. Kemp. 1968. Digestibility of cedar and balsam fir browse for the white-tailed deer. Journal of Wildlife Management 32(1):162-171.

U.S. Department of Interior. 1977. 1975 national survey of hunting, fishing, and wildlife-associated recreation. 91 p. U.S. Department of the Interior.

Urich, D. L. 1973. Nutrient levels in deer and moose forage in northern Minnesota as related to site characteristics. 138 p. M.S. Thesis University of Minnesota, St. Paul, Minnesota.

Verme, L. J. 1962. Mortality of white-tailed deer fawns in relation to nutrition. Proceedings National Deer Disease Symposium 1:15-38.

Verme, L. J. 1963. Effect of nutrition on growth of white-tailed deer fawns. Transactions North American Wildlife Conference 28:431-443.

Verme, L. J. 1965. Swamp conifer deer yards in northern Michigan. Journal of Forestry 63(7):523-529.

Verme, L. J. 1969. Reproductive patterns of white-tailed deer related to nutritional plane. Journal of Wildlife Management 33:881-887.

Verme, L. J., and D. E. Ullrey. 1972. Feeding and nutrition of deer. p. 275-291. *In* Digestive physiology and nutrition of ruminants, vol. 3: practical nutrition. D. C. Church, ed. publisher and Oregon State University Bookstores, distributor Corvallis, Oregon.

Waddell, B. H., Jr. 1973. Fall ecology of white-tailed deer in north central Minnesota. 46 p. M.S. Thesis. University of Minnesota, St. Paul, Minnesota.

Wallmo, O. C., and D. J. Neff. 1970. Direct observations of tamed deer to measure their consumption of natural forage. p. 105-110. *In* Range and Wildlife Habitat Evaluation—A Research Symposium. U.S. Department of Agriculture Forest Service, Miscellaneous Publication 1147, 220 p.

Wallmo, O. C., R. B. Gill, L. H. Carpenter, and D. W. Reichert. 1973. Accuracy of field estimates of deer food habits. Journal of Wildlife Management 37(4):556-562.

Wambaugh, J. R. 1973. Food habits and habitat selection by white- tailed deer, and forage selection in important habitats in northeastern Minnesota. 71 p. M.S. Thesis. University of Minnesota, St. Paul, Minnesota.

Watts, C. R. 1964. Forage preferences of captive deer while free- ranging in a mixed oak forest. 65 p. M.S. Thesis. Pennsylvania State University, University Park, Pennsylvania.

Weir, W. C., and D. T. Torell. 1959. Selective grazing by sheep as shown by a comparison of the chemical composition of range and pasture forage obtained by hand clipping and that collected by esophageal fistulated sheep. Journal of Animal Science 18:641-649.

Wetzel, J. F. 1972. Winter food habits and habitat preferences of deer in northeastern Minnesota. 106 p. M. S. Thesis. University of Minnesota, St. Paul, Minnesota.

APPENDIX

Table 1.—*Plants eaten by white-tailed deer in northern Minnesota in January*

(In estimated percents of the diet)[1]

	Feeding sites			Rumens
	North-central	Northeast		(northeast)
	1971-1974[2]	1971[3]	1972[4]	1971[3]
Beaked hazel	37	30	35	16
Mountain maple	10	29	25	3
Dogwood	1	15	10	6
Juneberry	12	6	14	2
Arboreal lichens			14	
Balsam fir	<1	<1	13	
Green alder	8	1	1	8
Blueberry	8			
Red maple		4	6	
Quaking aspen	2	4	1	
Paper birch	4	1	1	
Grasses	<1			4
Goldthread				4
Cherry	2	1	3	3
Labrador tea	3	2		1
White cedar		<1	3	<1
White pine	2			1
Black spruce				2
Wintergreen	2			
Willow	1	1	1	<1
Speckled alder		<1	<1	1
Bush-honeysuckle	<1	1		
Arrowwood		1	<1	
Red oak		<1	<1	
Honeysuckle		<1	<1	
Jack pine	<1			
Unidentified leaves				6
Unidentified twigs				15
Number examined	9	26	16	8
Number of bites	2,064	24,797	7,027	

[1]Not included in tables 1-3 and 12 are 22 taxa whose use by deer did not exceed 1.5 percent of the diet in any study in any month during December-March. These taxa include clubmoss, bracken fern, mosses, large-leaf aster, black medic, strawberry, marsh marigold, goldenrod, thistles, trailing arbutus, red raspberry, gooseberry, rose, red elderberry, leatherleaf, sweet gale, swamp birch, sumac, mountain-ash, black ash, balsam poplar, and red pine.

[2]Mooty (unpublished). Data for December-March were obtained by examining 43 feeding sites in Itasca County, north-central Minnesota, during 1971-1974. For a summary of these data by 2-month intervals, see Mooty (1976). Deer density during the study was 4 to 8 deer per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources.

[3]From Wetzel (1972). Data for December-March were obtained by examining 82 feeding sites and 32 wolf-killed rumens in St. Louis and Lake Counties in northeastern Minnesota during 1968-1971. Deer density was 4 to 6 deer per square kilometer and declining (P. D. Karns, 1979, personal communication; Mech and Karns 1977; Rogers *et al.* 1980).

[4]From Wambaugh (1973). Data for January-March were obtained by examining 50 feeding sites in 1972 in the same area that had been studied by Wetzel (above).

Table 2.—*Plants eaten by white-tailed deer in northern Minnesota in February*

(In estimated percents of the diet)[1]

	Feeding sites			Rumens
	North-central	Northeast		(northeast)
	1972[2]	1971[3]	1972[4]	1971[3]
White cedar		8		52
Beaked hazel	35	33	48	4
Mountain maple		29	37	
Labrador tea	14	1		
White pine	3		12	
Blueberry	10			
Jack pine	9			8
Juneberry	8	2	4	1
Dogwood		8	1	2
Willow	6	1	<1	
Speckled alder	5	2	<1	5
Balsam fir		1		5
Red maple		5	2	
Arboreal lichens				4
Honeysuckle	3		<1	
Quaking aspen		2	2	
Arrowwood		2	<1	
Green alder		2	<1	<1
Hawthorn	2			
American hazel	2			
Cherry	1	1	1	<1
Paper birch	<1	1	<1	1
Wintergreen	1			
Sweetfern	1			
Red oak		<1	<1	
Bush-honeysuckle		<1		
Black spruce				<1
Grasses, sedges				<1
Unidentified leaves				1
Unidentified twigs				4
Number examined	7	37	20	15
Number of bites	1,458	35,200	12,616	

[1]Not included in tables 1-3 and 12 are 22 taxa whose use by deer did not exceed 1.5 percent of the diet in any study in any month during December-March. These taxa include clubmoss, bracken fern, mosses, large-leaf aster, black medic, strawberry, marsh marigold, goldenrod, thistles, trailing arbutus, red raspberry, gooseberry, rose, red elderberry, leatherleaf, sweet gale, swamp birch, sumac, mountain-ash, black ash, balsam poplar, and red pine.

[2]Mooty (unpublished). Data for December-March were obtained by examining 43 feeding sites in Itasca County, north-central Minnesota, during 1971-1974. For a summary of these data by 2-month intervals, see Mooty (1976). Deer density during the study was 4 to 8 deer per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources.

[3]From Wetzel (1972). Data for December-March were obtained by examining 82 feeding sites and 32 wolf-killed rumens in St. Louis and Lake Counties in northeastern Minnesota during 1968-1971. Deer density was 4 to 6 deer per square kilometer and declining (P. D. Karns, 1979, personal communication; Mech and Karns 1977; Rogers *et al.* 1980).

[4]From Wambaugh (1973). Data for January-March were obtained by examining 50 feeding sites in the same area that had been studied by Wetzel (above).

Table 3.—*Plants eaten by white-tailed deer in northern Minnesota in March*

(In estimated percents of the diet)[1]

	Feeding sites			Rumens (northeast)	
	North-central	Northeast			
	1972[2]	1971[3]	1972[4]	1971[3]	1937[5]
Beaked hazel	52	44	51	4	
Balsam fir	1	<1		5	43
White cedar		26		35	3
Jack pine	5			17	
Mountain maple		12	16		
Pine					14
Juneberry	8	2	11		
Dogwood	3	1	4	9	<1
Paper birch	5	1	<1	1	5
Green alder	4	5	2		<1
Arrowwood		<1	<1		5
Arboreal lichens				5	
Red maple	<1	2	4		<1
Willow	1	1	<1	1	4
Cherry	1	1	<1	3	<1
Speckled alder		1	3		<1
Black spruce				1	3
Red oak	<1	<1	3		<1
Grasses, sedges				<1	3
Labrador tea		<1			3
Honeysuckle	3				
Quaking aspen	2	1	2		
White pine	2			1	
Blueberry	2				
Large-toothed aspen	1				
Bush-honeysuckle		<1			
Wintergreen	<1				
Bunchberry	<1				
Unidentified leaves				1	
Unidentified twigs				8	
Other material				7	
Number examined	15	15	14	4	51
Number of bites	3,700	19,666	6,228		

[1]Not included in tables 1-3 and 12 are 22 taxa whose use by deer did not exceed 1.5 percent of the diet in any study in any month during December-March. These taxa include clubmoss, bracken fern, mosses, large-leaf aster, black medic, strawberry, marsh marigold, goldenrod, thistles, trailing arbutus, red raspberry, gooseberry, rose, red elderberry, leatherleaf, sweet gale, swamp birch, sumac, mountain-ash, black ash, balsam poplar, and red pine.

[2]Mooty (unpublished). Data for December-March were obtained by examining 43 feeding sites in Itasca County, north-central Minnesota, during 1971-1974. For a summary of these data by 2-month intervals, see Mooty (1976). Deer density during the study was 4 to 8 deer per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources.

[3]From Wetzel (1972). Data for December-March were obtained by examining 82 feeding sites and 32 wolf-killed rumens in St. Louis and Lake Counties in northeastern Minnesota during 1968-1971. Deer density was 4 to 6 deer per square kilometer and declining (P. D. Karns, 1979, personal communication; Mech and Karns 1977; Rogers *et al.* 1980).

[4]From Wambaugh (1973). Data for January-March were obtained by examining 50 feeding sites in the same area that had been studied by Wetzel (above).

[5]From Aldous and Smith (1938). Data were obtained in northeastern Minnesota by examining 51 rumens from deer that had died of starvation, predation, sickness, exposure, or having been struck by vehicles late in the winter of 1936-1937. Deer density was 4 to 8 per square kilometer according to deer drives conducted by the Civilian Conservation Corps in the Superior National Forest in 1936.

Table 4.—*Plants eaten by white-tailed deer in north-central Minnesota in April of 1970 and 1971*

(In estimated percents of diet)[1]

	Feeding sites	Rumens
White-cedar		48
Beaked hazel	21	2
Green alder and speckled alder	2	18
Bush-honeysuckle	15	
Grasses	14	
Red osier dogwood	10	
Late low blueberry	9	
Juneberry	6	
Goldenrod (dead)	5	
Sedges	5	
Black ash	3	
Honeysuckle	3	
Marsh marigold	3	
Lichens		2
Unidentified woody browse		30
Number of sites or rumens examined	11	5
Number of bites	1,833	

[1]From Pierce (1975). Data were obtained by examining 39 feeding sites and 3 rumens in Itasca County, north central Minnesota, during April-June 1970-1971. Five rumens from deer that starved in April in Itasca County were examined. Deer density was 4 to 8 per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources. Items used in amounts less than two percent in April included twigs of paper birch, quaking aspen, and cherry and sprigs of jack pine and white pine. Bush-honeysuckle, grass, sedge, and marsh marigold were eaten mainly in late April after some snow had melted.

Table 5.—*Plants eaten by white-tailed deer in north-central Minnesota in May of 1970 and 1971*

(In estimated percents of diet)[1]

	Feeding sites	Rumens
Grasses	45	7
Sedges	17	
Willow	3	6
Goldenrod (dead)	5	
Marsh marigold	5	
Red osier dogwood	4	2
Wood anemone	4	
Bracken fern		4
Trailing arbutus		3
False lily-of-the-valley	3	
Rose	3	
Yellow bellwort	3	
Late low blueberry	3	
Large-leaf aster	2	
Clinton's lily	2	
Unidentified leaves		64
Unidentified forbs		13
Number of sites or rumens examined	16	3
Number of bites tallied	4,595	

[1]From Pierce (1975). For additional details of the study, see footnote to table 4. Items used by deer in amounts less than 2 percent in May include hazel, quaking aspen, and pyrola.

Table 6.—*Plants eaten by white-tailed deer in the northern Great Lakes Region in June*

(In estimated percents of the diet)[1]

	Feeding sites (Minnesota)		Rumens		Observation of tame deer (Michigan)	
	Forest[2]	Burn[3]	Minnesota[4]	Wisconsin[5]	Aspen[6]	Clearcut[6]
Aspen	1	16	6	29	21	37
Red maple and mountain maple	8	22	14	5	1	9
Bracken fern	13		<		19	7
Dogwood	1		18			
Beaked hazel	9	4			14	16
Bush-honeysuckle	1		16	5		
Strawberry	2		5	15	4	9
Wild sarsaparilla	14				<	
Lily family	2			12	3	<
Water milfoil		11				
Raspberry					8	5
Willow	8		1		4	<
Hawkweed			8		2	<
Honeysuckle	8					
Grasses and sedges	7	3	6	6	2	2
Chokecherry			1		7	6
Aster, mainly large-leafed aster	6		1		6	2
Paper birch	1	6	2			<
Sweet pea	5		5			
Yellow bellwort	4					
Goldenrod	3		2		3	<
Bunchberry	3				<	<
Juneberry	2		2			
Miscellaneous species		20				
Unidentified leaves			9			
Number of sites or rumens examined	12	6	3	24		
Number of bites	2,763	492				

[1]Plants whose use by deer did not reach 2 percent of the diet in any study in June were mushrooms, pyrola, bluebell, spreading dogbane, violet, goosefoot, bedstraw, common dandelion, yarrowm pearly everlasting, indian hemp, hedge bindweed, scarlet columbine, fireweed, thistle, late low blueberry, thimbleberry, currant, rose, arrowwood, black ash, bur oak, and white spruce.

[2]From Pierce (1975). For additional details of the study, see footnote to table 4.

[3]From Irwin (1974). Data were obtained by examining 52 feeding sites in the Little Sioux Burn area in St. Louis County, northeastern Minnesota during April-December 1973. Deer density was 4 to 6 per square kilometer (P. D. Karns, 1979, personal communication).

[4]From Kohn (1970). Data were obtained by examining 31 feeding sites and 9 rumens in Itasca County, north-central Minnesota, during June-August 1968-1969. Deer population data are as for Pierce (1975) (above). Kohn did not mention by name 11 browse and 20 forb taxa each of which accounted for no more than 2 percent of the diet in any month of study.

[5]From McCaffery *et al.* (1974). Data were obtained in northern Wisconsin during 1969-1970 by examining 76 rumens from road-killed deer (15 in April-May, 42 in June-September, 19 in October-November). Seventy genera, excluding genera of grasses, sedges, and mushrooms, were found in the 76 rumens, but 17 items accounted for 80 percent of the aggregate volumes for April-November. These 17 items were aspen leaves (16 percent), graminoids (1 percent), barren strawberry (7 percent), aster (5 percent), bush-honeysuckle (6 percent), strawberry (4 percent), cherry (4 percent), oak acorns (6 percent), wintergreen (3 percent) clover (4 percent), mushrooms (2 percent), maple leaves (2 percent), solomon's seal (2 percent), false lily-of-the-valley (2 percent), and bunchberry (2 percent). Approximately monthly break-downs are available for June only. Deer density was 6 to 8 per square kilometer and declining (Wm. F. Creed, 1978, personal communication).

[6]From Bauer (1977). Data were obtained by observation of 3 tame, harnessed deer in a 10-acre mature aspen stand and in an adjacent 10-acre 1-year-old aspen clearcut during June-August 1976 in Dickinson County in Michigan's Upper Peninsula. Deer density was 11 per square kilometer and declining (L. F. Verme, 1979, personal communication).

Table 7.—*Plants eaten by white-tailed deer in the northern Great Lakes Region in July*

(In estimated percent of the diet)[1]

	Feeding sites (Minnesota)		Rumens (Minnesota)	Observations of tame deer (Michigan)	
	Forest[7]	Burn[3]	Forest[4]	Aspen[6]	Clearcut[6]
Aspen	7	3	22	26	20
Beaked hazel	26			9	20
Strawberry	3		11	10	17
Red and mountain maple	10	5	16	8	13
Goldenrod	1	12	4	2	3
Choke and pin cherry	<1	12	4	3	2
Bracken fern	3		3	12	3
Asters, mainly large-leafed aster	9	10		3	5
Raspberry	1			10	6
Rough cinquefoil		10			
Willow	9			4	2
Juneberry	3	8	2		
Spotted jewelweed	3	8			
Bush-honeysuckle	<1	2	7		
Grasses and sedges	1		6	2	2
Violet	<1		5		
Paper birch	3	4	1		<1
Common geranium			4		
Water milfoil		4			
Fireweed	3				
Clover	2	2			
Hedge bindweed				2	2
False lily-of-the-valley	1			2	<1
Hawkweed				2	<1
Spreading dogbane	1		2		
Bicknell's geranium	2				
Mushrooms	<1		2		
Arrowwood	2				
Unidentified leaves			7		
Miscellaneous species		17			
Number of feeding sites or rumens examined	21	8	3		
Number of bites tallied	5,098	778			

[1]Plants whose use by deer did not reach 2 percent of the diet in August included Hawkweed, common dandelion, rough cinquefoil, pyrola, pearly everlasting, black snakeroot, meadow rue, indian hemp, bluebell, sweetfern, barren strawberry, arrowwood, thistle, bedstraw, mint, wild lettuce, hedge bindweed wild sarsaparilla, honeysuckle, green alder, and white spruce.

[3]From Irwin (1974). Data were obtained by examining 52 feeding sites in the Little Sioux Burn area in St. Louis County, northeastern Minnesota during April-December 1973. Deer density was 4 to 6 per square kilometer. (P. D. Karns, 1979, personal communication).

[4]From Kohn (1970). Data were obtained by examining 31 feeding sites and 9 rumens in Itasca County, north-central Minnesota, during June-August 1968-1969. Deer population data are as for Pierce (1975) (above). Kohn did not mention by name 11 browse and 20 forb taxa each of which accounted for not more than 2 percent of the diet in any month of study.

[6]From Bauer (1977). Data were obtained by observation of 3 tame, harnessed deer in a 10-acre mature aspen stand and in an adjacent 10-acre 1-year-old aspen clearcut during June-August 1976 in Dickinson County in Michigan's Upper Peninsula. Deer density was 11 per square kilometer and declining (L. F. Verme, 1979 personal communication).

[7]Mooty (unpublished). Data were obtained by examining feeding sites in Itasca County, north-central Minnesota during 1968-1971. For a summary of these data by 2-month intervals, see Mooty (1976). Some of the data used by Mooty were contributed by Kohn (1970) and Waddell (1973). Deer density was 4 to 8 per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources.

Table 8.—*Plants eaten by white-tailed deer in the northern Great Lakes Region in August*

(In estimated percent of the diet)[1]

	Feeding sites (Minnesota)		Rumens	Observations of tame deer (Michigan)	
	Forest[7]	Burn[3]	(Minnesota)[4]	Aspen[6]	Clearcut[6]
Aspen	8		12	23	9
Beaked and american hazel	15	<2		15	23
Bush-honeysuckle	7	20	9		
Strawberry	1	<1		9	17
Mushrooms			17		
Choke and pin cherry	3	16	6	4	<1
Asters, mainly large-leafed aster	15	<2	6	13	2
Red and mountain maple	5	5	9	2	15
Raspberry and Blackberry	<1			13	4
Clover	4	11			
Paper birch	6	8	<1		1
Fireweed		8			
Willow	6	5	3	7	2
Spreading dogbane	6	1			
Spotted jewelweed	6				
Buckbean	5				
Wild sweet pea	3		4		
Grasses and sedges	1		3	1	2
Juneberry	1	<2	4		
Lillies, mainly Clinton's lily	3			2	<1
American Vetch	1		3		
Bristly Sarasparilla	<1	3			
Fringed bindweed		3			
Goldenrod	2		<1	2	2
Rose	1		2		
Bracken fern	1			2	<1
Dogwood	2		1		
Thimbleberry	2				
Violet	2				
Blueberry	2				
Basswood	2				
Unidentified leaves			14		
Miscellaneous plants		21			
Number of feeding sites or rumens examined	26	8	3		
Number of bites	7,964	570			

[1]Plants whose use by deer did not reach 2 percent of the diet in any study in August included Hawkweed, common dandelion, rough cinquefoil, pyrola, pearly everlasting, black snakeroot, meadow rue, indian hemp, bluebell, sweetfern, barren strawberry, arrowwood, thistle, bedstraw, mint, wild lettuce, hedge bindweed wild sarsaparilla, honeysuckle, green alder, and white spruce.

[3]From Irwin (1974). Data were obtained by examining 52 feeding sites in the Little Sioux Burn area in St. Louis County, northeastern Minnesota during April-December 1973. Deer density was 4 to 6 per square kilometer. (P. D. Karns, 1979, personal communication).

[4]From Kohn (1970). Data were obtained by examining 31 feeding sites and 9 rumens in Itasca County, north-central Minnesota, during June-August 1968-1969. Deer population data are as for Pierce (1975) (above). Kohn did not mention by name 11 browse and 20 forb taxa each of which accounted for not more than 2 percent of the diet in any month of study.

[6]From Bauer (1977). Data were obtained by observation of 3 tame, harnessed deer in a 10-acre mature aspen stand and in an adjacent 10-acre 1-year-old aspen clearcut during June-August 1976 in Dickinson County in Michigan's Upper Peninsula. Deer density was 11 per square kilometer and declining (L. F. Verme, 1979 personal communication).

[7]Mooty (unpublished). Data were obtained by examining feeding sites in Itasca County, north-central Minnesota during 1968-1971. For a summary of these data by 2-month intervals, see Mooty (1976). Some of the data used by Mooty were contributed by Kohn (1970) and Waddell (1973). Deer density was 4 to 8 per square kilometer and declining, according to annual spring pellet counts conducted by the Minnesota Department of Natural Resources.

Table 9.—*Plants eaten by white-tailed deer in northern Minnesota in September*

(In estimated percentages of the diet)[1]

	Forested feeding sites[8]	Burned feeding sites[3]
Bush-honeysuckle	24	36
Asters, mainly large-leafed aster	33	3
Pin cherry		20
Fringed bindweed		11
Clover	10	9
Mountain maple	9	4
Willow	6	2
Bristly sarsaparilla		6
Clinton's lily	3	<2
Goldenrod	3	
Bracken fern	3	
Red maple	2	<2
Rose	2	<2
Miscellaneous plants		9
Number of feeding sites	12	5
Number of bites tallied	2,932	490

[1]Plants whose use by deer did not reach 2 percent in either study in August included raspberry, blackberry, grass, sedge, bunchberry, strawberry, thistle, beaked hazel, American hazel, quaking aspen, and arrowwood.

[3]From Irwin (1974). Data were obtained by examining 52 feeding sites in the Little Sioux Burn area in St. Louis County, northeastern Minnesota during April-December 1973. Deer density was 4 to 6 per square kilometer (P. D. Karns, 1979 personal communication).

[8]From Waddell (1973). Data were obtained by examining 41 feeding sites during August-October 1970-1971 in Itasca County, north-central Minnesota. Waddell did not mention by name 56 plant taxa, each of which accounted for not more than 2 percent of the diet in any of the 3 months of study. Deer density was four to eight square kilometer according to census data collected by the Minnesota Department of Natural Resources.

Table 10.—*Plants eaten by white-tailed deer in northern Minnesota in October*

(In estimated percentages of the diet)[1]

	Forested feeding sites[8]	Burned feeding sites[3]
Red maple		49
Grasses and sedges	29	5
Bush-honeysuckle	13	
Beaked and american hazel	1	12
Clover	7	11
Aster, mainly large-leafed aster	11	
Bunchberry	8	2
Goldenrod	8	
Paper birch	1	7
Wintergreen	5	2
Quaking aspen	5	2
Jack pine		4
Juneberry		4
Raspberry and blackberry	2	2
Strawberry	2	2
Common thistle	2	
Hedge bindweed	2	
Miscellaneous plants		8
Number of feeding sites examined	13	6
Number of bites tallied	5,483	480

[1]Plants whose use by deer did not reach 2 percent of the diet in either study in October included rose, willow, alder, and fireweed.

[3]From Irwin (1974). Data were obtained by examining 52 feeding sites in the Little Sioux Burn area in St. Louis County, northeastern Minnesota during April-December 1973. Deer density was 4 to 4 per square kilometer (P. D. Karns, 1979, personal communication).

[8]From Waddell (1973). Data were obtained by examining 41 feeding sites during August-October 1970-1971 in Itasca County, north-central Minnesota. Waddell did not mention by name 56 plant taxa, each of which accounted for not more than 2 percent of the diet in any of the 3 months of study. Deer density was 4-8 per square kilometer according to census data collected by the Minnesota Department of Natural Resources.

Table 11.—*Plants eaten by white-tailed deer in the northern Great Lakes Region in November*

(In estimated percentages of the diet as determined from rumen analyses).

	Northeast Minnesota		Northern Wisconsin
	1967-1969[1]	1936[2]	1943[3]
Large-leaf aster	25		
Eastern hemlock		20	
Quaking aspen and balsam poplar	4	17	11
White-cedar		9	15
Balsam fir		13	12
Grasses	11	3	<2
Willow	1	11	
Birch	10	<2	
Bunchberry	8	2	<2
Red osier dogwood	8		
Pine (mainly jack pine)	1	7	7
Green and speckled alder	3	<1	5
Labrador tea		5	
Apple	5		
Bog laurel	4		
Currant or gooseberry	4		
Wintergreen			4
Beaked and American hazel	1	<1	3
Twinflower	3	<1	
Rose		3	
Maple		2	2
Mushrooms, lichens, and moss		2	<2
Common thistle	2		
Wood fern			2
Wild sweet pea	2		
Composite family		2	
Unidentified twigs	12	12	1
Number of rumens examined	14	21	387

[1]From Wetzel (1972). Data for November were obtained by examining 14 rumens from deer killed by hunters in St. Louis and Lake Counties in northeastern Minnesota during 1967-1969. Deer density was 4 to 6 per square kilometer (P. D. Karns, 1978, personal communication), and the population was declining (Mech and Karns 1977; Rogers *et al.* 1980). Wetzel omitted and did not name 25 items that he found only in trace amounts during the 3 years he analyzed rumens.

[2]From Aldous and Smith (1938). Data for November were obtained by examining 21 rumens from deer killed by hunters in northeastern Minnesota in 1936. Items which Aldous and Smith found to comprise less than 1 percent of the diet included black spruce, basswood, clubmoss, raspberry, juniper, goldenrod, clover, grape, grape fern, hardhack, ironwood, loosestrife, sheep sorrel, elm, cherry, and oak.

[3]From Dahlberg and Guettinger (1956). Data for November were obtained by examining 387 rumens from deer killed by hunters in northern Wisconsin in 1943. Fifty plant species, in addition to those listed in table 11, were listed by Dahlberg and Guettinger as contributing trace amounts to the diet.

Table 12.—*Plants eaten by white-tailed deer in northern Minnesota in December*

(In estimated percentages of the diet as determined through examination of feeding sites)[1]

	Forested feeding sites		Burned feeding sites
	Northeast[2]	North central[3]	Northeast[4]
Dogwood	44	16	
Red maple	10	<1	40
Sweetfern			23
Beaked and American hazel	13	22	
Jack pine		2	19
Mountain maple	15	<1	2
Blueberry		15	
Wintergreen		12	
Labrador tea		<1	9
Juneberry	7	6	2
Green alder		6	
Bunchberry		4	
Bush-honeysuckle	3	2	
Willow	<1	3	
Quaking aspen	2	<1	<2
Sedge		2	
Miscellaneous plants			5
Number of feeding sites examined	4	12	10
Number of bites tallied	2,112	1,861	782

[1]Plants whose use by deer did not reach 2 percent in any of the studies in December included thistles, trailing arbutus, clubmoss, strawberry, honeysuckle, red raspberry, balsam poplar, paper birch, cherry, staghorn sumac, rose, red oak, black ash, and white pine.

[2]From Wetzel (1972). For additional details of that study, see footnote 3 of table 1.

[3]Mooty (unpublished). For additional details of that study, see footnote 7, table 7.

[4]From Irwin (1974). For additional details of that study, see footnote 3, table 6.

COMMON AND SCIENTIFIC NAMES OF PLANTS EATEN BY DEER IN THE UPPER GREAT LAKES REGION

Common name	Scientific name	Season eaten[1]
TREES:		
American beech	*Fagus grandifolia*	
American elm	*Ulmus americana*	
American larch or tamarack	*Larix laricinia*	
Apple	*Pyrus* spp.	F
Ash	*Fraxinus* spp.	
Aspen	*Populus* spp.	Su, F, W
Balsam fir	*Abies balsamea*	F, W
Balsam poplar	*Populus balsamifera*	F
Basswood	*Tilia americana*	W

Birch	*Betula* spp.	F, W
Bitternut hickory	*Carya cordiformis*	
Black ash	*Fraxinus nigra*	W
Black cherry	*Prunus serotina*	W
Black spruce	*Picea mariana*	
Blue beech	*Carpinus caroliniana*	
Box elder	*Acer negundo*	
Bur oak	*Quercus macrocarpa*	W
Butternut	*Juglans cinerea*	
Eastern hemlock	*Tsuga canadensis*	F
Elm	*Ulmus* spp.	
Green ash	*Fraxinus pennsylvanica*	W
Hornbeam or Ironwood	*Ostrya virginiana*	
Jack pine	*Pinus banksiana*	F, W
Large-toothed aspen	*Populus grandidentata*	Su, W
Maple	*Acer* spp.	Su, W
Mountain-ash	*Sorbus americana*	W
Oak	*Quercus* spp.	Su, W
Paper birch	*Betula papyrifera*	Su, F, W
Pine	*Pinus* spp.	F, W
Quaking aspen	*Populus tremuloides*	Su, F
Red maple	*Acer rubrum*	Su, F, W
Red oak	*Quercus rubra*	
Red pine	*Pinus resinosa*	
Silver maple	*Acer saccharinum*	
Sugar maple	*Acer saccarum*	
Swamp birch	*Betula pumila*	
White-cedar	*Thuja occidentalis*	Sp, F, W
White pine	*Pinus strobus*	W
White spruce	*Picea glauca*	
Wild crab	*Pyrus angustifolia*	
Yellow birch	*Betula lutea*	

SHRUBS AND VINES:

Alder	*Alnus* spp.	Sp, F, W
Alderleaf buckthorn	*Rhamnus alnifolia*	
Alternate-leaved dogwood	*Cornus alternifolia*	W
American hazel	*Corylus americana*	Su, F,
Arrowwood	*Viburnum* spp.	
Beaked hazel	*Corylus cornuta*	Sp, Su, F, W
Bearberry	*Arctostaphylos uva-ursi*	
Blackberry and raspberry	*Rubus* spp.	Su
Black-haw	*Viburnum lentago*	
Blueberry	*Vaccinium* spp.	Sp, W
Bog birch	*Betula pumila*	
Bog laurel	*Kalmia polifolia*	
Bog rosemary	*Andromeda glaucophylla*	
Buffalo berry	*Sheperdia argentea*	
Bush-honeysuckle	*Diervilla lonicera*	Sp, Su, F
Canadian fly honeysuckle	*Lonicera canadensis*	
Cherry	*Prunus* spp.	Su
Chokeberry	*Pyrus melanocarpa*	W
Choke cherry	*Prunus virginiana*	Su
Common elder	*Sambucus canadensis*	

Creeping snowberry	*Gaultheria hispidula*	
Currant	*Ribes* spp.	
Swamp currant	*Ribes lacustre*	
Dogwood	*Cornus* spp.	Sp, Su, W
Downy arrow-wood	*Viburnum rafinesquianum*	W
Eastern blackberry	*Rubus allegheniensis*	
Elderberry	*Sambucus* spp.	
Gooseberry	*Ribes* spp.	
Gray dogwood	*Cornus racemosa*	W
Greenbriar	*Smilax* spp.	
Green alder	*Alnus crispa*	Sp, W
Hairy honeysuckle	*Lonicera hirsuta*	
Hardhack	*Spiraea tomentosa*	
Hawthorn	*Crataegus* spp.	
Hazel	*Corylus* spp.	Sp, Su, F, W
Highbush blueberry	*Vaccinium corymbosum*	
Highbush cranberry	*Viburnum trilobum*	W
Honeysuckle	*Lonicera* spp.	Su
Juneberry	*Amelanchier* spp.	Sp, Su, W
Juniper	*Juniperus* spp.	
Labrador tea	*Ledum groenlandicum*	F, W
Late low blueberry	*Vaccinium angustifolium*	Sp
Leatherleaf	*Chamaedaphne calyculata*	
Leatherwood or moosewood	*Dirca palustris*	
Lilac	*Syringa vulgaris*	
Meadow rose	*Rosa blanda*	
Meadow sweet	*Spiraea latifolia, S. alba*	
Mountain-holly	*Nemopanthus mucronatus*	
Mountain maple	*Acer spicatum*	Su, W
New Jersey tea	*Ceanothus americanus*	
Ninebark	*Physocarpus opulifolius*	
Northern holly or winterberry	*Ilex verticillata*	
Northern yew	*Taxus canadensis*	
Pin cherry	*Prunus pennsylvanica*	Su
Pipsissewa	*Chimaphila umbellata*	
Poison Ivy	*Rhus radicans*	
Prairie willow	*Salix humilis*	
Prickly ash	*Xanthoxylum americanum*	
Raspberry	*Rubus strigosus*	Su
Red-berried elder	*Sambucus pubens*	
Red osier dogwood	*Cornus stolonifera*	Sp, Su, F, W
Red-panicle dogwood	*Cornus racemosa*	
Rose	*Rosa* spp.	
Round-leaved dogwood	*Cornus rugosa*	W
Small cranberry	*Vaccinium oxycoccus*	
Smooth climbing honeysuckle	*Lonicera dioica*	
Smooth sumac	*Rhus glabra*	
Snowberry	*Symphoricarpos albus*	
Speckled alder	*Alnus rugosa*	Sp, W
Sumac	*Rhus* spp.	W
Swamp honeysuckle	*Lonicera oblongifolia*	
Sweetfern	*Comptonia peregrina*	W
Sweet gale	*Myrica gale*	
Thimbleberry	*Rubus parviflorus*	

Thornapple	*Crataegus* spp.	
Trailing arbutus	*Epigea repens*	
Twinflower	*Linnaea borealis*	
Velvetleaf blueberry	*Vaccinium myrtilloides*	
Wild grape	*Vitis riparia*	
Wild plum	*Prunus americanus*	
Wild raisin	*Viburnum cassinoides*	
Willow	*Salix* spp.	Sp, Su, F, W
Wintergreen	*Gaultheria procumbens*	F, W
Witch hazel	*Hamamelis virginiana*	
Woodbine or virginia creeper	*Parthenocissus inserta*	

HERBACEOUS PLANTS:

Alfalfa	*Medicago sativa*	
American vetch	*Vicia americana*	
Arrowhead	*Sagittaria latifolia*	
Aster	*Aster* spp.	Su
Barren strawberry	*Waldsteinia fragaroides*	Su
Bedstraw	*Galium* spp.	
Black medic	*Medicago lupulina*	
Black snakeroot	*Saricula marilandica*	
Bladder campion	*Silene cucubalus*	
Bladderwort	*Utricularia* spp.	
Bluebell	*Mertensia paniculata*	
Bristly sarsaparilla	*Aralia hispida*	Su
Buckbean	*Menyanthes trifoliata*	Su
Buckwheat	*Fagopyrum* spp.	
Bunchberry	*Cornus canadensis*	F
Bur-reed	*Sparganium* spp.	
Clinton's lily	*Clintonia borealis*	
Clover	*Trifolium* and *Melilotus*	Su, F
Common dandelion	*Taraxacum officinale*	
Common geranium	*Geranium bicknellii*	
Common twisted-stalk	*Streptopus roseus*	
Composite family	*Compositae*	
Coontail	*Ceratophyllum demersum*	
Corn	*Zea mays*	
Cow parsnip	*Heracleum lanatum*	
Dock	*Rumex* spp.	
Early sweet pea	*Lathyrus ochroleucus*	Su
False lily-of-the-valley	*Maianthemum canadense*	
False Solomon's seal	*Smilacina trifolia*	
Filamentous algae	*Spirogyra* spp.	
Fireweed	*Epilobium angustifolium*	Su
Flat-top white aster	*Aster umbellatus*	
Forking catchfly	*Silene dichotoma*	
Fringed bindweed or false buckwheat	*Polygonum cilinode*	Su
Garden pea	*Pisum sativum*	
Goldenrod	*Solidago* spp.	Sp, Su, F
Goldthread	*Coptis groenlandica*	
Goosefoot	*Chenopodium* spp.	
Graminoids	*Gramineae and Cyperaceae*	
Grasses	*Gramineae*	Sp, Su, F
Harebell	*Campanula rotundifolia*	

Hawkweed	*Hieracium* spp.	
Hedge bindweed	*Convolvulus sepium*	
Hemp or marijuana	*Cannabis sativa*	
Horseweed	*Erigeron canadensis*	
Indian Hemp	*Apocynum cannabinum*	
Kidney bean	*Phaseolus* spp.	
Lady's thumb	*Polygonum persicaria*	
Large-leaf aster	*Aster macrophyllus*	Su, F
Lily family	*Liliaceae*	Sp, Su
Loosestrife	*Lysimachia* spp.	
Marsh cinquefoil	*Potentilla palustris*	
Marsh marigold	*Caltha palustris*	Sp
Milkweed	*Asclepias* spp.	
Night-flowering catchfly	*Silene noctiflora*	
Northern St. John's-wort	*Hypericum boreale*	
Pale touch-me-not	*Impatiens pallida*	
Pearly everlasting	*Anaphalis margaritaceae*	
Pigweed	*Amaranthus* spp.	
Pitcher plant	*Sarracenia purpurea*	
Purple watershield	*Brasenia schreberi*	
Pyrola	*Pyrola* spp.	
Ragweed	*Ambrosia* spp.	
Ribbonleaf pondweed	*Potamogeton epihydrus*	
Rough cinquefoil	*Potentilla norvegica*	Su
Scarlet columbine	*Aquilegia canadensis*	
Sedges	*Cyperaceae, including Carex* spp.	Sp, Su, F
Sheep sorrel	*Rumex acetosella*	
Showy smartweed	*Polygonum amphibium*	
Smooth aster	*Aster laevis*	
Solomon's seal	*Polygonatum* spp.	
Soybean	*Glycine max*	
Spikerush	*Eleocharis* spp.	
Spotted jewelweed	*Impatiens capensis*	Su
Spreading dogbane	*Apocynum androsaemifolium*	Su
Strawberry	*Fragaria* spp.	Su
Sunflower	*Helianthus* spp.	
Sweet clover	*Melilotus* spp.	
Sweet pea	*Lathyrus* spp.	Su
Sweet water-parsnip	*Sium sauve*	
Thistle	*Cirsium* spp.	
Three-way sedge	*Dulichium* spp.	
Violet	*Viola* spp.	Su
Water horsetail	*Equisetum fluviatile*	
Water milfoil	*Myriophyllum* spp.	Su
Wheat	*Triticum aestivum*	
White clover	*Trifolium repens*	
Wild carrot or Queen Anne's lace	*Daucus carota*	
Wild lettuce	*Lactuca canadensis*	
Wild rice	*Zizania aquatica*	
Wild sarsaparilla	*Aralia nudicaulis*	Su
Wild sweet pea	*Lasthyrus venosus*	Su
Wood anemone	*Anemone quinquefolia*	
Yarrow	*Achillea millifolium*	

Yellow bellwort	*Uvularia grandiflora*	
Yellow trout lily	*Erthronium americanum*	
FUNGI:		
Bracket fungi	*Daedalia* spp. *Lenzites* spp. *Polyporus* spp. *Schizophyllum* spp.	
Mushrooms		Su
LICHENS:		
Old man's beard	*Usnea* spp.	
Arboreal lichens[2]	*Mainly Usnea* spp. and *Evernia* spp.	W
FERNS AND FERN ALLIES:		
Bracken fern	*Pteridium aquilinum*	Su
Clubmoss	*Lycopodium* spp.	
Grape fern	*Botrychium* spp.	
Shield fern	*Dryopteris* spp.	
Wood fern	*Dryopteris* spp.	
Mosses	*Unidentified mosses*	
Pigeonwheat moss	*Polytrichum* spp.	

[1]Season of use is designated only for those species found to comprise 5 percent or more of the diet in at least one study in the given season. Sp = April-May, Su = June-September, F = October-November, W = December-March.

[2]Alectoria spp. was reported as eaten in one study but later was found to be a misidentification of Usnea spp. and Evernia spp. lichens.

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Available information on year-round food habits of white-tailed deer in the Upper Great Lakes Region (UGLR) is summarized. Problems of deer in that region are discussed. There is a need for additional information on year-round diet, but new study techniques must be developed if a complete picture of diet is to be obtained.

KEY WORDS: year-round diet, starvation, predation, reproduction, winter conditions, study techniques.